The College Board

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COLLEGE-LEVEL EXAMINATION PROGRAM

Natural Sciences

Description of the Examination

The CLEP General Examination in Natural Sciences covers a wide range of topics frequently taught in introductory courses surveying both biological and physical sciences at the freshman or sophomore level. Such courses generally satisfy distribution or general education requirements. The Natural Sciences exam is not intended for those specializing in science; it is intended to test the understanding of scientific concepts that an adult with a liberal arts education should have. The exam emphasizes the knowledge and application of the basic principles and concepts of science, the comprehension of scientific information, and the understanding of issues of science in contemporary society.

The primary objective of the exam is to give candidates the opportunity to demonstrate a level of knowledge and understanding expected of college students meeting a distribution or general education requirement in the natural sciences. Colleges may grant up to six semester hours (or the equivalent) of credit toward fulfillment of such a requirement, for satisfactory scores on the exam. Some may grant specific course credit, on the basis of the total score for a two-semester survey course covering both biological and physical sciences.

The test contains 120 multiple-choice questions to be answered in two separately timed 45-minute sections, one covering biological science, the other physical science.

Knowledge and Skills Required

Questions on the exam require candidates to demonstrate one or more of the following abilities.

- Knowledge of fundamental facts, concepts, and principles (about 40 percent of the exam).
- Interpretation and comprehension of information (about 20 percent of the exam), presented in the form of graphs, diagrams, tables, equations, or verbal passages.

- Qualitative and quantitative application of scientific principles (about 40 percent of the exam), including applications based on material presented in the form of graphs, diagrams, tables, equations, or verbal passages. More emphasis is given to qualitative than quantitative applications.

The subject matter of the General Examination in Natural Sciences is drawn from the following topics.

	Approximate Percent of Examination
	Biological Science (50%)
10%	Origin and evolution of life, classification of organisms
10%	Cell organization, cell division, chemical nature of the gene, bioenergetics, biosynthesis
20%	Structure, function, and development in organisms; patterns of heredity
10%	Concepts of population biology with emphasis on ecology
	Physical Science (50%)
7%	Atomic and nuclear structure and properties, elementary particles, nuclear reactions
10%	Chemical elements, compounds and reactions; molecular structure and bonding
12%	Heat, thermodynamics, and states of matter; classical mechanics; relativity
4%	Electricity and magnetism, waves, light and sound
7%	The universe: galaxies, stars, the solar system
10%	The Earth: atmosphere, hydrosphere, structure, properties, surface features, geological processes, history

The exam includes some questions that are interdisciplinary and cannot be classified in one of the above categories. Some of the questions on the exam cover topics that overlap with those listed above, drawing on areas such as history and philosophy of science, scientific methods, science applications and technology, and the relationship of science to contemporary problems of society, such as environmental pollution and depletion of energy supply. Some questions on the exam are laboratory oriented.

Sample Questions

The following sample questions are provided to give an indication of the types of questions that appear on the General Examination in Natural Sciences.

Before attempting to answer the sample questions, read all the information about the Natural Sciences exam on the preceding pages. Additional suggestions for preparing for CLEP exams are provided in Chapter 1.

Try to answer as many questions as possible. Then compare your answers with the correct answers, given at the end of this examination guide.

Directions: Each group of questions below consists of five lettered choices followed by a list of numbered phrases or sentences. For each numbered phrase or sentence select the one choice that best describes it. Each choice may be used once, more than once, or not at all in each group.

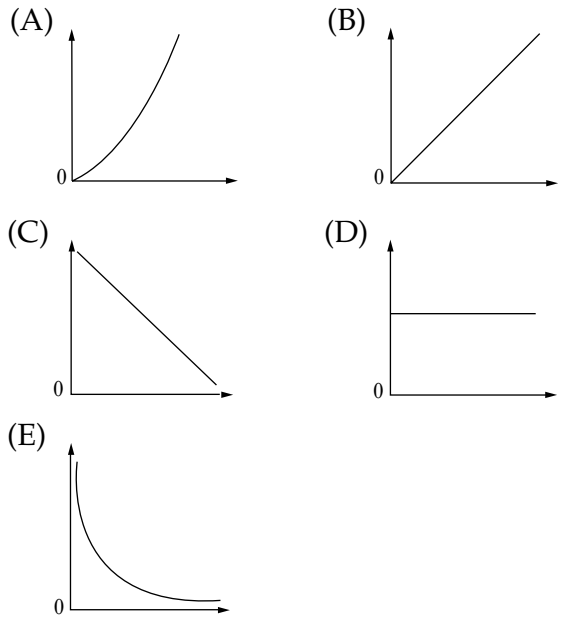
Questions 1-2

(A) Cell wall
(B) Cell membrane
(C) Nucleus
(D) Mitochondrion
(E) Ribosome

1. The chief site of energy production in the cell Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

2. The site of protein synthesis in the cell Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

Questions 3-5



3. A sample of gas remains at constant temperature.
   Vertical axis: Volume of the sample
   Horizontal axis: Pressure on the sample
   Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

4. An object moves at constant speed.
   Vertical axis: Distance traveled since time t = 0
   Horizontal axis: Time
   Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

5. A constant unbalanced force acts on an object.
   Vertical axis: Acceleration of the object
   Horizontal axis: Time
   Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

Directions: Each of the questions or incomplete statements below is followed by five suggested answers or completions. Select the one that is best in each case.

6. As a direct result of photosynthesis, energy is stored in molecules of which of the following?

   (A) RNA (B) DNA (C) glucose
   (D) H_2O (E) CO_2
   Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

7. A person whose gallbladder has been removed has a decreased ability to store bile and therefore to digest

   (A) fats (B) starches (C) sugars
   (D) proteins (E) vitamins

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

Questions 8-9

In fruit flies, "straight wings" (S) is dominant over "curly wings" (s), and gray body color (G) is dominant over black body color (g). A straight-winged female with gray body color was mated with a straight-winged male with black body color and the following ratios of offspring resulted. The experiment was conducted at 25°C.

Ratio	Phenotype
3/8	straight-winged; gray body color
3/8	straight-winged; black body color
1/8	curly-winged; gray body color
1/8	curly-winged; black body color

8. The data above suggest that the genotype of the male parent is

   (A) SsGg (B) SSGg (C) ssgg
   (D) Ssgg (E) ssGg

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

9. The data above suggest that the genotype of the offspring with curly wings and black body color is

   (A) SsGg (B) SSGg (C) ssgg
   (D) Ssgg (E) ssGg

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

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10. The classification characteristics that define the genus of an animal or a plant are usually more general than those defining

    (A) a class (B) an order (C) a species
    (D) a family (E) a phylum

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

11. Which of the following adaptations is more likely to be found in the leaves of desert plants than in those of plants that grow in moist regions?

(A) Stomata mostly on upper leaf surface
(B) A thin, transparent cuticle
(C) A smooth leaf surface free of hairs
(D) A thickened epidermis and cuticle
(E) A loosely packed mesophyll layer

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

12. In embryonic origin, nerve cells are most similar to

(A) epidermal cells
(B) bone cells
(C) red blood cells
(D) liver cells
(E) reproductive cells

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

13. Which of the following best completes the statement below?

"Among multicellular animals, the insects exhibit the greatest diversity of life-forms; therefore _____."

(A) the total number of insect species is limited
(B) the presence of wings on an insect is probably an evolutionary error
(C) insects probably occupy the greatest number of niches
(D) insect control by human beings is simplified
(E) any genetic mutation in fruit flies is likely to escape detection

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

14. A father will transmit the genes of his Y chromosome to

(A) one-half of his sons only
(B) one-half of his daughters only
(C) all of his sons only
(D) all of his daughters only
(E) none of his sons

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

15. A theory fails to meet the criteria of scientific methodology if

(A) it is unpopular
(B) it contradicts other theories
(C) it has not been conclusively proved
(D) it has not been stated in mathematical terms
(E) no experiments can be designed to test it

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

16. Dark lines in the Sun's spectrum are explained as resulting from

(A) emission of radiation of certain frequencies from the Sun's atmosphere
(B) absorption of energy by atoms in the outer layers of the Sun
(C) radiation of ultraviolet light from sunspots
(D) continuous radiation from the corona
(E) x-rays emanating from the Sun's atmosphere

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

17. Which of the following best describes the principal way in which the Earth's atmosphere is heated?

(A) Heat flows from the center of the Earth and is conducted through the ground to the air.
(B) The atmosphere absorbs short-wave radiation from the Sun as the Sun's rays pass through it.
(C) The Earth absorbs short-wave radiation from the Sun and reradiates long-wave radiation which is absorbed by the atmosphere.
(D) The air absorbs short-wave radiation from the Sun after it has been reflected by the clouds.
(E) Warm air rises and cold air sinks and, as it sinks, it is warmed by compression.

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

18. Which of the following natural resources is NOT a fossil fuel?

(A) Uranium (B) Natural gas (C) Petroleum
(D) Anthracite (E) Bituminous coal

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

19. The half-life of $^{14}_{6}C$ is 5,600 years. Which of the following statements about a 10-gram sample of $^{14}_{6}C$ is correct?

(A) The radioactive decay of the sample will be complete after 5,600 years.
(B) The $^{14}_{6}C$ sample will start radioactive decay after 5,600 years.
(C) A time of 5,600 years has been required to produce this sample of $^{14}_{6}C$ in nature.
(D) After 5,600 years the sample will contain only 5 grams of $^{14}_{6}C$.
(E) After 11,200 years the sample will not contain any $^{14}_{6}C$.

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

20. Of the following planets that are visible with the naked eye (Venus, Mars, Jupiter, Saturn), only Venus has an orbit smaller than that of Earth. This means that Venus

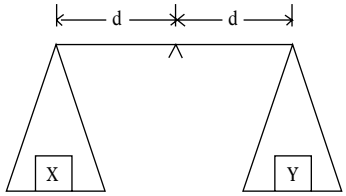
(A) is seen only in the morning or the evening sky
(B) can be seen in the sky near midnight more often than at other times
(C) can rarely be seen at all
(D) has an orbit that is more elliptical than that of the Earth
(E) has a longer year than the Earth

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

21. An unsorted mixture of clay, boulders, sand, and silt would most likely be deposited from which of the following?

(A) Glacial ice (B) Subsurface water
(C) Streams (D) Waves (E) Wind

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ



22. The balance shown above is in equilibrium at the Earth's surface and the two arms have the same length d. Thus the two objects, X and Y (not necessarily drawn to scale), must have identical

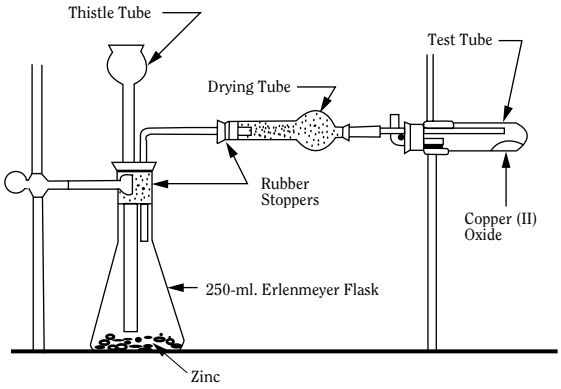
    (A) densities (B) masses (C) shapes
    (D) specific gravities (E) volumes

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

Questions 23-25

$$CuO + H_2 \longrightarrow Cu + H_2O$$

The drawing below depicts an apparatus for reducing copper(II) oxide to the metal by the reaction above.



23. In order to produce a stream of hydrogen gas for this reaction, one should add which of the following through the thistle tube?

    (A) Water
    (B) Dilute hydrochloric acid
    (C) Dilute copper (II) sulfate solution
    (D) Hydrogen peroxide
    (E) Dilute ammonia solution

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

24. After the production of hydrogen gas starts, withdrawing the thistle tube would result in which of the following?

    (A) Moisture would collect in the flask.
    (B) The evolution of hydrogen gas would stop.
    (C) Much hydrogen gas would escape without coming in contact with the copper oxide.
    (D) Air would enter the flask faster than hydrogen gas would be evolved.
    (E) The rate of production of hydrogen gas would increase.

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

25. Which of the following would most likely increase the effectiveness of the hydrogen gas reducing the copper(II) oxide?

    (A) Heating the test tube
    (B) Cooling the test tube
    (C) Putting the test tube under reduced pressure
    (D) Filling the test tube with dilute HCl solution
    (E) Filling the test tube with dilute NaOH solution

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

Study Resources

Visit a local college bookstore to determine which textbooks are used by the college for natural science courses. To prepare for the Natural Sciences exam, students are advised to study from more than one textbook to cover all the subject matter, selecting at least one biological science and one physical science textbook. When choosing a textbook, students should check the table of contents against the "Knowledge and Skills Required" section on pages 1-2.

If students maintain an interest in scientific issues, read science articles in newspapers and magazines, watch public television programs such as "Nova," or work in fields that require a knowledge of certain areas of science such as nursing and laboratory work, they will probably be knowledgeable about many of the topics included on the Natural Sciences exam. The Internet is another resource students could explore.

Additional suggestions for preparing for CLEP exams are provided in Chapter 1.

Answers to Sample Questions

Natural Sciences

1. D
2. E
3. E
4. B
5. D
6. C
7. A
8. D
9. C
10. C
11. D
12. A
13. C
14. C
15. E
16. B
17. C
18. A
19. D
20. A
21. A
22. B
23. B
24. C
25. A